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PRN:		Course Code :	MET 2501

Third Year **B. Tech** End Semester Examination Winter 2023

Dynamics of Machines

Day and Date: Wednesday, 29/11/2023 Max Marks: **100**

Time : 10.30 am to 1.30 PM Duration: **03** hrs

Instructions: All questions are compulsory.

			Marks	Bloom's Level	CO
Q.1		**Attempt the following**			
	a)	State and prove the law of gearing.	08	2	CO1
	b)	The number of teeth on each of the two equal spur gears in mesh are 40. The teeth have 20° involute profile and the module is 6 mm. If the arc of contact is 1.75 times the circular pitch, find the addendum.	08	1	CO1
		OR			1
	b)	A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio.	08		
Q.2		**Attempt the following**		2	CO2
	a)	Explain the procedure to analyse an epicyclic gear train.	08	2	CO2
	b)	In an epi-cyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 r.p.m. in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed, makes 300 r.p.m. in the clockwise direction, what will be the speed of gear B ?	08	2	CO2
		OR			
	b)	An epicyclic gear consists of three gears A, B and C as shown in Fig. 1. The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the centre of A at 18 r.p.m. If the gear A is fixed, determine the speed of gears B and C.	08	2	CO3

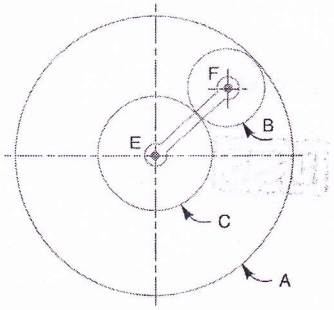


Fig 1

Q.3		**Attempt any two from the following**		2	CO3
	a)	What is a flywheel? What is its use?	08		
	b)	Find a relation for the coefficient of fluctuation of speed in terms of maximum fluctuation of energy and kinetic energy of the flywheel at mean speed.	08	2	CO3

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	c)	The turning moment diagram for a petrol engine is drawn to a vertical scale of 1 mm =500 N-m and horizontal scale of 1 mm = 3°. The turning moment diagram repeats itself at every half revolution of the crankshaft. The areas above and below the mean torque line are 260, -580, 80, -380, 870 and -250 mm^2. The rotating parts are equivalent to a mass of 55 kg at a radius of gyration of 2.1 m. Determine the coefficient of fluctuation of speed when the engine runs at 1600 r.p.m.	08	2	CO4
Q.4		**Attempt any two from the following**			
	a)	State and explain D' Alembert's principle.	08	2	CO4
	b)	A horizontal gas engine running at 210 rpm has a bore of 220 mm and stroke of 440 mm. The connecting rod is 924 mm long and the reciprocating parts weigh 20 kg. When the crank has turned through an angle of 30 from the inner dead centre, the gas pressures on the cover and crank sides are 500 kN/m^2 and 60 kN/m^2 respectively. Diameter of the piston rod is 40 mm. Determine turning moment on the crank shaft.	08	1	CO4
	c)	What do you mean by dynamic equivalent system? Explain.	08	1	CO4
Q.5		**Attempt any Two of the following**			
	a)	Why is balancing necessary for rotors of high speed engines?	09	2	CO4
	b)	Three masses of 8 kg, 12 kg and 15 kg attached at radial distances of 80 mm, 100 mm and 60 mm respectively to a disc on a shaft are in complete balance. Determine the angular positions of the masses of 12 kg and 15 kg relative to the 8 kg mass.	09	1	CO4
	c)	Four masses m1, m2, m3 and m4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.	09	1	CO5
Q.6		**Attempt any Two of the following**			
	a)	What do you understand by gyroscopic couple? Derive a formula for its magnitude.	09	2	CO5
	b)	A uniform disc of diameter 300 mm and of mass 5 kg is mounted on one end of an arm of length 600 mm. The other end of the arm is free to rotate in a universal bearing. If the disc rotates about the arm with a speed of 300 r.p.m. clockwise, looking from the front, with what speed will it precess about the vertical axis?	09	1	CO5
	c)	What is effect of gyroscopic couple on the aeroplanes.	09	1	CO5

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